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**Title:** **DELIVERY SYSTEM AND METHOD**

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# Title: DELIVERY SYSTEM AND METHOD

## FIELD OF THE INVENTION

This invention relates generally to delivery systems and methods and more particularly to an improved system and method for product delivery.

## BACKGROUND OF THE INVENTION

Typically, sellers of products either ship a certain amount of product to retail outlets for on-site purchase by customers. The disadvantage of shipping products to retail outlets for on-site purchase is that prospective purchasers must physically attend at the retail outlets to purchase said product. Also, when the product is over-sold, there is often a substantial re-stocking delay before the product is available again for purchase, causing potential purchasers to put off or abandon plans to order a product from a seller. To avoid stock outages, seller's carry excess inventory tying up capital, and often requiring mark downs at the end of the selling season in order to liquidate excess stock.

Alternatively, sellers wait until an order is received from purchaser before shipping a product directly to purchaser. Both of these methods of product delivery suffer from substantial disadvantages. The disadvantages associated with shipping a product to a purchaser after an order has been received include the expense of using high-speed delivery mechanisms (e.g. air freight) to provide the purchaser with the product in a timely fashion. If it is not desired to incur the substantial costs associated with high-speed delivery then there typically is a substantial delivery period. Either the high cost or the substantial delivery period can discourage purchasers from purchasing products from seller.

Substantial resources are spent each year to improve delivery time by creating faster and faster modes of transportation and warehousing and order- picking technology. Conventional delivery systems typically achieve "time-to-customer" improvements by increasing the speed of shipping

or increased expediting (i.e. order picking or processing speed). Also, conventional distribution systems require repeated physical labeling by various parties (e.g. the manufacturer, the distributors, etc.).

## SUMMARY OF THE INVENTION

The invention provides in one aspect, a method of delivering one of a plurality of identical products associated with a seller to a purchaser, said method comprising:

(a) transporting the identical products in a delivery circuit that includes a plurality of delivery nodes by transporting the identical products between delivery nodes at a first speed;

(b) determining if one of said identical products has been ordered by one of the purchasers;

(c) if (b) is true then determining which of said plurality of delivery nodes is closest to said purchaser;

(d) providing the closest one of said identical products to the delivery node identified in (c) along the delivery circuit and then transporting said closest one of said identical products from the delivery node identified in (c) to said purchaser.

In another aspect, the invention provides a delivery system for delivering a plurality of identical products associated with a seller to a plurality of purchasers, said system comprising:

(a) a first delivery module for transporting the identical products in a delivery circuit that includes a plurality of delivery nodes at a first speed;

(b) a distribution module associated with said first delivery module for determining if one of the products has been ordered by said one of the purchasers, and if so then determining which

of said plurality of delivery nodes is closest to said one of the purchasers; and

(c) a second delivery module associated with said distribution module for providing the closest of said identical products to said identified delivery node through said delivery circuit and then from said identified delivery node to said one of the purchasers.

Further aspects and advantages of the invention will appear from the following description taken together with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is block diagram illustrating the operation of the delivery system of the present invention;

FIG. 2 is a flowchart illustrating the general operational steps of the delivery system of FIG. 1;

FIG. 3 is a block diagram of the delivery system of FIG. 1 illustrating the exchange of information between seller, distributor and the distribution nodes of the circulation circuit of FIG. 1;

FIG. 4A is a schematic representation of the seller's record maintained within the seller database of FIG. 3;

FIG. 4B is a schematic representation of the distributor's record maintained with the distributors database of FIG. 3;

FIG. 5A is a flowchart illustrating the process steps of the CIRCULATION routine conducted by the delivery system of FIG. 1;

FIG. 5B is a flowchart illustrating the process steps of the SOLD routine conducted by the delivery system of FIG. 1;

FIG. 6 is a block diagram illustrating how the delivery system of FIG. 1 manages the flow of products within delivery circuit 25; and

FIG. 7 is a flowchart illustrating how product demand is forecasted and how product rebalancing is achieved within the delivery system of FIG. 1.

## DETAILED DESCRIPTION OF THE INVENTION

Reference is first made to FIG. 1, which shows a block diagram of the delivery system **10** made in accordance with a preferred embodiment of the present invention. Delivery system **10** achieves time-efficient delivery of products **12** from a seller **14** through a distributor **16** to a purchaser **18** through the transportation of products 12 within a delivery circuit **25** that includes a plurality of delivery nodes **20a** to **20e** and a delivery sub-circuit **30** that includes a plurality of delivery sub-nodes **22a** to **22c**. The nodes in each of the delivery circuit **25** and sub-circuit **30** are interconnected through a web of transportation links as shown in FIG. 1. Products **12** are transported within a delivery circuit **25** that covers a general geographical area based on estimates of product demand for product **11** within that geographical area, such that at the time of an order by purchaser **18**, the required number of products **12** can be efficiently transported from the closest delivery node **20a** to **20e** within delivery circuit **25** to a closest delivery node **22a** to **22c** within sub-circuit **30** for direct delivery to purchaser **18**.

Purchaser **18** is physically located within the geographical area covered by delivery nodes **20a** to **20e** and can either represent a retail store (e.g. SEARS, WALMART, etc.) or an end purchaser/consumer (e.g. a mail or Internet order customer). Delivery system **10** provides a retail store purchaser **18** with quick stock replenishment without expensive delivery mode (e.g. air freight, local warehousing). Also, delivery system **10** provides an end consumer purchaser **18** with quick delivery.

Seller **14** is a conventional wholesale, retail or mail order sales entity (e.g. TOYS R US, SONY, etc.) of products **12** who initially owns products **12** and seeks to sell products **12** to retail or end consumer purchasers **18**. Delivery system **10** is particularly suited to sellers **14** who sell a substantial number of identical (i.e. interchangeable) products **12** to a

plurality of purchasers **18** throughout the delivery circuit **25**. Seller **14** wishes to have sufficient products **12** available within delivery circuit **25** so that product **12** can be re-directed to retail or end-consumer purchasers **18** within a predetermined period of time from the time of order (e.g. 24 hours). In the case of retail store purchasers **18**, this means providing stock replenishment for example within a 24-hour period to ensure that retail store purchaser **18** can maintain a minimal level of stock in-store (i.e. stock depth), while minimizing the risk of being completely out of stock of that particular product.

Distributor **16** can either be a conventional distributor (e.g. UPS, FEDEX, etc.) of products **12** or a logistics and supply chain management entity who coordinates and provides transportation of products **12** between seller **14** and purchaser **18** using delivery system **10**. Distributor **16** utilizes the dynamic nature of delivery system **10** (i.e. which allows products **12** to be re-rerouted in transit as will be described) to ensure efficient delivery of product **12** from seller **14** to purchaser **18**. It should be understood that distributor **16** could also be the same entity as the seller **14**.

Delivery nodes **20a** to **20e** and sub-nodes **22a** to **22c** are sorting stations that provide conventional package sorting functions and limited warehousing. Products **12** are sorted using electronic or manual means at delivery nodes **20a** to **20e** and sub-nodes **22a** to **22c**. A unique Universal Tracking Number (UTN) is assigned to each product **12** and the distribution product (which will be described) record associated with each such UTN within a product container is used to identify the specific routing information associated with that product **12** (or products **12** within a package of product **12)** which is then in turn used to route product **12** within delivery system 10. A backbone computer network (e.g. connected via. the Internet as will be described in relation to FIG. 3) allows delivery nodes **20a** to **20e** and sub-nodes **22a** to **22c** to exchange product related record information with distributor **16**.

Distribution product record data as will be described is either 'pushed' or 'pulled' to local on-site sorting node databases to pre-load relevant routing information into the local sorting node database in advance of product **12** reaching the sorting node at issue. More specifically, the UTN record data

associated with all of the products **12** within a product container is pushed to the node database before the container of products **12** reaches the node. Using this approach, it is possible to quickly ascertained the contents and routing requirements associated with the contents of a container and accordingly minimize the typical delay associated with retrieving container/product related information from an off-site database. Also, it is possible to facilitate high speed package sorting without the risk of data "under run" errors. Delivery nodes **20a** to **20e** and sub-nodes **22a** to **22c** also include a small warehousing area as well as loading bays, conveyor belts, sorting bins/areas that interface with various transportation modes (e.g. rail, truck, air etc.) as is conventionally known. Conventionally, computerized package sorting systems conduct high speed package sorting based on associated zip codes. However, delivery system 10 requires modification of such conventional sorting equipment to allow for package sorting based on the reading or scanning of the UTN record are looking up the destination or routing information from the distribution product record.

Delivery nodes **20a** to **20e** are configured to form a delivery circuit **25** with a web of transportation links connecting each of the nodes as shown in FIG. 1. It should be understood that the specific number and configuration of delivery nodes **20a** to **20e** depicted in FIG. 1 have been chosen for illustrative purposes and that many different configurations are possible. The delivery nodes **20a** to **20e** in this example span a wide geographical area (e.g. from New York to Texas, to California and back through Oregon, and Michigan). It is preferred for slow and cost effective transport to be utilized along the delivery circuit **25** (e.g. freight train etc.) It should be understood that while a simple delivery circuit **25** is provided in FIG. 1 for illustrative purposes, many different delivery circuits could be utilized by a particular seller **14** within delivery circuit **25**. For example in the case where a seller **14** has only "released" a product in the New York state region of the U.S., a particular delivery circuit could be delineated to encompass delivery nodes **20a** and delivery sub-nodes **22a** to **22c** only.

Delivery sub-nodes **22a** to **22c** are configured to form a delivery sub-circuit **30** as shown. It should be understood that the specific number and

confirmation of number sub-nodes **22a** to **22c** depicted in FIG. 1 have again been chosen for illustrative purposes and that many different specific configurations are possible. As shown, the number sub-circuit **30** spans a smaller region than that spanned by number nodes **20a** to **20e** and specifically in the New York state region (e.g. from New York City, to Buffalo to Albany).

Product **12** can enter delivery system **10** at any one of various points along delivery circuit **25**. For example, when a seller **14** and distributor **16** are located within the geographical region of delivery circuit **25** (i.e. in this case within the U.S.), products **12** can either all be forwarded by distributor **16** directly to one node (e.g. node **20a** New York) or they can be forwarded by distributor **16** to a number of nodes simultaneously (e.g. to node **20a** New York, node **20c** California and node **20d** Oregon). As the products 12 move from node to sub-node it should be understood that they are sorted and possibly redistributed into different shipping containers as needed for proper transport to the next node or sub-node. For example, when products **12** reach node 20a (i.e. New York) they are sorted by the next level of geographic or routing detail (e.g. New York City, Albany, Buffalo). The New York City products **12** are consolidated along with other packages into appropriate shipping containers and freighted to the New York City sub-node **22c** and the Buffalo products 12 are consolidated into separate shipping containers and sent to the Buffalo sub-node 22b and so on.

Referring now to FIGS. 1 and 2, the general operational steps **50** of delivery system **10** are illustrated. At step (**54**), products **12** are provided by seller **14** to distributor **16** for circulation within delivery circuit **25**. At step (**56**), distributor **16** puts products **12** into delivery circuit **25**. At step (**58**), products **12** are transported within delivery circuit **25.** More specifically, products **12** are distributed from an entry point to the various nodes in an efficient and direct manner avoiding as much as possible the need to pass through intermediate nodes in order to reach the destination node. At step (**60**), it is determined whether product **12** has been ordered by purchaser **18**. If not, then at step (**58**) product **12** continues to be transported within delivery circuit **25**. If so, then at step (**62**), distributor **16** determines which delivery

node **20a** to **20** within delivery circuit **25** is closest to purchaser. For the purposes of this example, it should be assumed that purchaser **18c** has ordered product **12**. Accordingly, distributor **16** will determine that delivery node **20a** in New York state is closest (of all delivery nodes within circulation circuit **25**).

At step (**64**), the various UTN codes are searched to determine the product **12** that is closest to the delivery node identified in step (**62**) along circulation circuit **25**. Once the closest product **12** is identified (by UTN code) (e.g. if product **12** is at delivery node **20a** in New York state), at step (**66**), the final shipping address is inserted into the distribution record for that product **12** (as will be described) and product **12** is transported to delivery sub-circuit **30**. At step (**68**), distributor **16** determines which delivery sub-node is closest to purchaser and transports product **12** to that sub-node. In this example, the closest sub-node would be delivery sub-node **22b** in Buffalo, New York. At step (**70**), it is determined whether product **12** is at the closest delivery sub-node. Finally at step (**72**), product **12** is delivered from delivery sub-node **22b** to purchaser **18**.

At step (**74**), estimated and actual demand for product is assessed and then it is determined whether additional products **12** are required to be transported within delivery circuit **25**. Generally, purchaser demand for product **12** is periodically estimated within delivery system **10** and is expressed in terms of a 'par' product velocity (e.g. 12 units per day) for a particular node (e.g. delivery sub-node **22c**). If additional products **12** are required, then at step (**76**), additional products are shipped. If not, then at step (**54**), seller **14** provides additional products **12** to distributor **16** for delivery using delivery system **10**. If so, then at step (**58**), the existing volume of products **12** are simply further transported around delivery circuit **25**. The preferred product demand estimation methodology utilized within delivery system **10** is based on the principle that product sold should be replaced. That is, if product is sold from a delivery sub-node (e.g. New York City sub-node **22c**), then the 'parent' node (e.g. New York delivery node **20a**) should deploy replacement product **12** to that delivery sub-node and seller **14** should add

replacement product **12** to delivery system **10** to replenish the product concentration at that delivery node **20a**.

It should be understood that for the clarity of illustration, the specific delivery method shown in FIG. 2 assumes that the product delivery circuit **25** only consists of delivery nodes (i.e. not sub-nodes). However, it should be understood that the delivery circuit **25** could also contain delivery sub-nodes as well.

Referring now to FIGS. 1, 2, 3, 4A and 4B the exchange of delivery and product related information between seller, distributor and the delivery nodes **20a** to **20e** and delivery sub-nodes **22a** to **22c** of FIG. 1 during the delivery of product **12** from seller **16** to purchaser **18** will be described. Specifically, FIG. 3 is a block diagram of the delivery system of FIG. 1 illustrating in more detail and FIGS. 4A and 4B illustrate an example sales product table **100** which contains sales product records (SPR) and a sample distribution product table **102** which contains distribution product records (DPR). Again, it should be understood that the specific configuration of delivery nodes **20a** to **20e** and delivery sub-nodes **22a** to **22c** have been arbitrarily chosen for illustrative purposes and that many other configurations of delivery nodes and sub-nodes may be utilized within delivery system **10**. It should be understood that the Unique Tracking Number (UTN) is a critical index field that is common amongst all of the databases shown in FIG. 3.

As shown in FIG. 3, seller **14** maintains a sales product database **30** containing sales product table **100** (FIG. 4A). Initially, seller **14** provides distributor **16** with products **12** for circulation within delivery circuit **25**. Seller **14** compiles sales product table **100** (FIG. 4A) for products **12**, containing records that each have, a Unique Tracking Number (UTN), a company-specific or internal Tracking Number (could be a company serial number for the product), a Stock Keeping Unit (SKU) identifier (e.g. "doll"), a Transportation Type, a Destination Node, a Default Destination Node, a Sold Indicator (i.e. boolean value YES or NO), a Sold Node (when Sold = YES), Final Destination Address, Date of Entry, Anticipated Arrival Time (at Destination Node), and a Last Updated fields. Seller **14** electronically forwards certain records from sales product table **100** to distributor **16** over

communication network **15** (e.g. over the Internet) as shown. Records within sales product table **100** are maintained and updated periodically as distributor **16** coordinates the movement of products **12** recorded in these records. The sales information associated with sales product table **100** is used for internal marketing and sales efforts as well as for forecasting purposes as will be further described.

As previously discussed, each product **12** is assigned a Universal Tracking Number (UTN) as well as an internal Tracking No. Also, the SKU is populated with the type of product at issue (e.g. "doll"). The Transportation Type is set to be the most appropriate type of transport (e.g. "Train", "Truck", etc.) for the trip to the associated Destination Node. The Destination Node is the next node at which product **12** will arrive and be sorted at. It should be understood that Destination Node is defined as being the next node at which products **12** may be rerouted. However, the Destination Node may not be the closest node in terms of physical proximity. For example, a product **12** in transit from the New York City sub-node **22c** to the Buffalo sub-node **22b** (and therefore the Destination Node would be set as **22b**) may actually be physically closer to sub-node **22a** Albany. However, in order to reroute the product it would be necessary for it to first arrive in the Buffalo sub-node **22b**.

A Default Destination Node is also provided for each product **12** so that delivery system **10** does not stall if the product **12** reaches the Destination Node before being sold. In this way, product **12** is always routed in a "look-ahead" fashion wherein the Destination Node is the next sorting node at which product **12** will arrive and the Default Destination Node is "one-step" ahead (i.e. the next destination should product **12** not be rerouted or sent directly to a purchaser). It should be noted that the Default Destination Node field is always populated whether or not a product **12** has been sold. It is the node to which product **12** will be sent upon arrival at the Destination Node in the absence of a sale or redirection. If the product **12** is not sold or rerouted, then the existing Default Destination Node will be entered as the Destination Node and a new node will be chosen as the Default Destination

Node according to system estimates of geographical product demand and rebalancing as will be discussed.

When product **12** is sold, the Final Destination Node field is populated and the Sold Indicator is set to "YES". Also, the delivery node at which product **12** has been sold is indicated in the Sold Node Field is recorded for replenishment calculation and forecasting purposes as will be described. The date at which product **12** entered delivery circuit **25** is also stored within the Date of Entry field. This is used to determine the optimal product **12** to send to a purchaser **18** in the case where two products **12** are equally close to a particular delivery node **20** (i.e. to prevent the existence of "stale" or "delivery worn" products **12** or to maximize stock rotation (i.e. following the well-known FIFO convention)).

The Anticipated Arrival Time field contains fixed date and time information as to when the package is expected to arrive at the Destination Node. (e.g. May 30, 2003 10:00PM). Thus, this is an estimate which is based on such things as mode of transportation, expected conditions, the distance to the Destination Node and the specific Destination Node. It is important to have fixed date information so that seller **14** knows 'by when' a particular product **12** needs to be rerouted, as it cannot be rerouted at the Destination Node unless the routing information in the appropriate record of the distribution product table **102** is updated prior to the arrival of the physical product and the associated distribution product record information at the Destination Node Thus, the Anticipated Arrival Time At Node gives an estimate as to by when new instructions must be issued in order to effect the rerouting of product **12**.

It should be noted however, that it would be desirable to not only enter the instructions by the Anticipated Arrival time but by a given amount of time prior to that. There are several reasons for this. For example, as stated above the Anticipated Arrival time is only and estimate and as such may not be entirely accurate. Product **12** may arrive early and therefore be sorted and sent to the next Node earlier than anticipated. Furthermore, there is a finite amount of time between the entering of the instructions within the system and the time at which this information has percolated to all relevant areas within

the system. Thus, it is possible that the instructions are entered prior to the arrival of the package at the Node but not early enough for the information to have been received and implemented by appropriately rerouting the package at the relevant node. Clearly this could create serious difficulties in which instructions are set and expected to be implemented but in fact are not.

Thus, in order to avoid any such difficulties, a blackout period may be instituted for a given time period just prior to the Anticipated Arrival Time. During this period changes will not be allowed to the records. The duration of such a period could be function of the standard deviation of the error associated with the Anticipated Arrival Time. For example, if the error in estimating the Anticipated Arrival Time is the dominant factor, setting a black out period of a given multiple of the error would approximately ensure a given percentage accuracy that the issued instructions would in fact have sufficient time to be implemented.

Finally, the Last Updated field is used to determine when the product record has been last updated and will flag any "inactive" or potentially lost products **12** within delivery system **10**.

Similarly, distributor **16** maintains a distribution product database **32** that contains distribution product table **102** (FIG. 4B). Upon receiving sales product table **100** and associated products **12**, distributor **16** utilizes certain records and information from sales product table **100** and certain defaults to populate the fields of its own internal distribution product table **102**. Specifically, each record within distribution product table **102** consists of a Seller ID (i.e. to track various client sellers **18**), a Universal Tracking Number (UTN), Container ID, Transportation Type, Destination Node, Default Destination Node, Sold Indicator, Sold Node, Anticipated Arrival Time (at Destination Node), Final Destination Address, Date of Entry, Delivered Indicator, and Special Delivery Instructions. Many of these fields have been detailed above and it should be understood that they have the same significance within distribution product table **102**.

The Seller ID is a unique identifier that is used to track the associated Seller for each product **12**. The Container ID is used to track and

identify the various UTN-indexed products **12** packaged within a truckload container or other shipping container. Accordingly, when a container of products **12** arrives at a delivery node identification can be accomplished relatively quickly. For example, the product records associated with container ID 505 can be quickly identified through an index search using "505" in the container ID field to provide information on which products are in the container and their routing information. The Container No., along with the associated UTN codes and the Default Destination Nodes (i.e. destination delivery nodes) are used to filter and "push" the appropriate distribution product table **102** to the relevant destination delivery nodes. The container ID field is updated after each sort, and it is contemplated that the container ID field can incorporate or be associated with information as to the location of origin of that container (i.e. the place where the last sort occurred). Furthermore, the anticipated arrival time of the container at its destination can also be used for purposes of scheduling the 'pushing' or 'pulling' of the appropriate distribution product table **102** to the destination nodes.

The Sold field is a boolean value which indicates whether the associated product **12** has been sold. If the product **12** has been sold then the Final Destination Address is populated and the Delivered field is populated with "NO". When the product **12** is delivered to purchaser **18** then the Delivered field is changed to "YES" and the record is removed from the distribution product table **102**.

Once products **12** are sent by seller **14** through distributor **16** towards delivery circuit **25**, the various record fields are routinely updated as product **12** approaches delivery circuit **25** and as product **12** traverses delivery circuit **25**. Seller **14** updates its records first and then pushes this information down to down to distributor's **16** records. That is, the various record fields within the system databases contain a digital "image" mapping of the delivery circuit **25** such that the location of each product **12** is known within the delivery circuit **25**. This allows a particular product **12** to be re-rerouted or sent to a final destination based on accurate information regarding when a particular product **12** is scheduled to reach the next sorting node.

Specifically, as shown in FIG. 4B, the first two products **12** received from seller **14** (i.e. dolls with UTN 42-456 and 23-543) have been sold to purchasers within New York State and a third one (UTN 54-234) that has not yet been sold. A Default Destination Node is provided for each product **12** so that delivery system **10** does not stall if said product reaches the Destination Node prior to being sold. Accordingly, it should be noted that the Default Destination field is always populated whether or not a product **12** has been sold. It is the node to which product **12** will be sent upon arrival at the Destination Node, should it not be rerouted or sent directly to a purchaser. Thus, should the product **12** not be sold or rerouted the node listed in the Default Destination Node field will be entered in the Destination Node field and a new node will be chosen as the Default Destination node. Of course, should it be desired that upon arrival, product **12** be rerouted to a different node, the Destination Node may be updated accordingly and need not become what is currently entered in the Default Destination Node field. The Default Destination Node field is updated every time a new Destination Node is set.

For illustrative purposes, it should be assumed that these three products **12** have reached distribution node **20a** (i.e. New York State). Thus, the first product **12** (i.e. with UTN = 42-456) has one day until arrival at the location of the first purchaser **18** (i.e. the New York City sub-node **22c**) and two days until arrival at the location of the second purchaser **18** (i.e. the Buffalo city sub-node **22b**) as indicated by the geographical placement of the delivery nodes shown in FIG. 1. The corresponding Anticipated Arrival Times are provided in the distribution product table **102** as shown. Finally, the third product **12** has not been sold and accordingly the Anticipated Arrival Time field shows the time at which the product is expected to arrive at the next Destination Node.

When the third product **12** reaches delivery node **20b** and if it has not yet been sold (i.e. sold field = "NO"), then the Destination Node will be equated to the Default Destination Node (i.e. node Texas **20b** and Default Destination Node will be assigned a new valve (e.g. "California Node **20c**")), so that it continues to traverse delivery circuit **25** as shown in FIG. 1.

Accordingly, the default setting can be arbitrary (e.g. such that product **12** traverses along a 'dumb' delivery circuit). Alternatively, it can be set and updated such that product **12** is directed to delivery nodes **20a** to **20e** and sub-nodes **22a** to **22c** which need replenishment due to sales or based on statistical demand analysis for the type of product **12** being shipped at particular delivery nodes **20a** to **20e** nodes and sub-nodes **22a** to **22c**. The setting and updating of the Default Destination field for each product **12** is preferably modeled on a "par" flow rate required in each zone. For example, it could be determined that the zone associated with sub-node **22a** needs at least five units of product **12** cycling through it per day, and that the zone associated with node **22e** needs ten units of product **12** cycling through it per day. The Default Destination within each distribution product record could be set accordingly.

Referring to FIGS. 3, 4A, 4B, 5A and 5B, the dynamic nature of Sales product table **100** and distribution product table **102** and their use within delivery system **10** will be specifically illustrated. Specifically, FIG. 5A is a flowchart illustrating the process steps of the CIRCULATION routine **105** conducted by the delivery system **10** of FIG. 1.

At step (**103**), a Universal Tracking Number (UTN) is affixed to product **12**. Preferably, the UTN is affixed at or prior to the time of product shipment by seller **14**. It should be understood that it is contemplated that seller **14** could place a bar code containing a UTN at the time of manufacture and that this UTN code number would be used by any distributor **18** (i.e. shipping company) to obtain routing information over communication network **15**. That is, in analogy to the conventional numbering scheme utilized by cheques (i.e. with a unique identifier for both the financial institution and customer), it is contemplated that the UTN would consist of a company code (i.e. assigned to a specific company and not assigned to any other company) followed by a serial number that represents the particular product **12**. In this way, no two products **12** in the system **10** will have the identical UTN code. This would also allow, for example, products **12** being shipped from China, to be routed and distributed while on the ship. Upon landing at the dock, the cargo can be immediately provided to delivery system **10** and delivered using

the UTN for routing purposes. This approach reduces the amount of manual handling of the goods for labeling, consolidating, order-picking etc. It should also be understood that the UTN code itself does not have to be in any particular form as long as it is utilized as a common index between seller **14** and distributor **16**.

Accordingly, when distributor **16** receives products **12** from seller **14**, a Universal Tracking Number (UTN) has already been associated with each product **12**. Then at step (**104**), distributor **16** creates an associated distribution product table **102** with the UTN as the key (i.e. index) field and stores this record in distribution database **32**. It should also be understood that products **12** according to the meaning of the present invention, can either represent individual products in the conventional sense (i.e. individual dolls) or larger collection of products (e.g. boxes containing a plurality of products such as a box of three soap bars). As discussed above, containers of products **12** can be themselves identified by the Container ID within the distribution product table **102**. At step (**106**), distributor **16** physically sends products **12** (typically using cost effective surface type transport such as rail freight transport) to relevant delivery nodes **20a** to **20e** and to delivery sub-nodes **22a** to **22c** within delivery circuit **25** based on calculated Default Destination Node information provided by seller **14**. Also, at step (**106**), the distribution product table **102** is updated.

At step (**107**), the Anticipated Arrival Time at the Destination Node is calculated and placed in Anticipated Arrival Time field in the distribution product table **102**. The Destination Node field of the sales product table **100** is also updated so that seller **14** can determine the deadline for updating the Default Destination Node field in the distribution product table **102**. It should be understood that this step has to be completed before the distribution product table **102** is pushed to the applicable delivery node. At step (**108**), seller **14** assigns products **12** by their UTN codes to purchaser orders that come in based on the location of the product **12** (i.e. as revealed by a lookup of the UTN code within the distribution product table **102** and the distribution product table **102** is updated with these changes in sellers **14** data. Also, it should be understood that seller **14** sends sales data associated

with the applicable UTN codes to distributor **16** for incorporation into distribution product table **102** prior to scheduled data push to node.

At step (**110**), distributor **16** pushes the updated distribution product table **102** to the relevant delivery nodes for storage within node databases **21a** to **21e** and sub-node databases **23a** to **23c**. This is accomplished prior to the arrival of the container bearing the applicable products **12** so that all records associated with products **12** located in the container can be loaded into the automatic barcode sorter software within the applicable node databases prior to physical arrival of products **12**.

Now referring to FIG. 5B, FIG. 5B illustrates the process steps of the SOLD routine **115** conducted by the delivery system **10** of FIG. 1. Once products **12** reach delivery circuit **25**, they are available for re-direction to purchaser **18**. If seller **14** receives a product order at step (**112**), then at step (**114**), distributor **16** determines the closest delivery node **20a** to **20e** to the ordering purchaser **18**. At step (**116**), a search of the sales product table **100** is conducted to determine whether there is a record for a product with the Destination Node field equal the node found in step (**114**) and for which the Sold field is "NO". If at step (**118**), it is determined that there is no match then step (**114**) is repeated and the next closest node is determined. Step (**116**) is repeated as well.

This process is continued until at least one match is found. If at step (**118**) it is determined that there is more than one match, then at step (**120**) the product with the earliest Anticipated Arrival Time (AAT) is selected. If there is more than one such product, then the product with the oldest date of entry is selected. At step **(122)** the Final Destination Address field in the sales product record for the selected product is updated with the final address information and the Sold field is set equal to "YES". At the same step the Default Destination Node field is cleared since this product has a final destination and there is no longer any need for the Default Destination Node. Then, at step **(124)** these changes are "pushed" down to the distribution product table **102**.

At this point, it should be understood that the foregoing is based on the assumption that all products **12** having the same SKU and the same Seller ID are identical and interchangeable. As an example illustration of this process, assume that purchaser in this case is purchaser **18a** that is located closest to delivery node **20b** (Texas). Referring to FIG. 4A, as indicated by the sales product record associated with (i.e. UTN = 54-234) in the sales product table **100**, this product **12** is available to be sold and has a Destination Node of Texas (i.e. this product **12** is being transported around delivery circuit **25** from New York state (node **20a**) to Texas (node **20b**). Accordingly, delivery system **10** would target this product **12** for delivery to purchaser **18a**.

Back at step (**114**), Texas (node **20b**) would be identified as the next closest delivery node. Then at step (**116**), the sales product table **100** is searched. At step (**118**) it is determined that there is a match with product with UTN = 54-234. Steps (**120**) and (**122**) are passed without any effect given that the identified product **12** is the only one found at step **116**. At step (**122**), sales product table **100** of this identified product **12** is updated to remove the Default Destination Node (i.e. to leave it blank since it has an actual destination). The appropriate record in sales product table **100** is also updated to include the specific destination (i.e. home or business address of purchaser **18a**) and to indicate that the product is sold ("YES") as well as to include any special delivery instructions.

Further, the specific transportation means may have to be adjusted depending on the remaining delivery distance between the product **12** and purchaser **18a** (i.e. from "train" to "plane") and on the grade of delivery required by seller **14**. Then at step (**124**) this information is pushed down to update the distribution product record within distribution product table **102**. In this way, delivery system **10** achieves delivery of products **12** to purchaser **18** by separating the addressing (i.e. routing information) from product **12** such that the route and destination can be dynamically adjusted through suitable changes in the appropriate distribution product table **102** (i.e. indexed by UTN). When, at step (**126**), this product **12** reaches delivery node **20b**, the UTN is read by a scanner or entered manually into a computer at delivery node **20b**, and the delivery database queried for the destination information

etc. and further processing and delivery of product **12** is achieved. After delivery, at step (**128**), the Delivered field is set to "YES" in order that the distribution product and sales product records for that UTN can be purged or archived.

Concurrently with the delivery, at step (**130**), the replenishment level is recalculated. This calculation consists of subtracting the outflow from the node from the inflow into the node. The inflow consists of any products **12** that have been delivered to this node or that are scheduled to be delivered to this node. The reason that the products **12** that are expected to arrive are also considered is to avoid problems similar to the "bullwhip effect" in which products that have been ordered but not yet arrived are ordered again, causing a build up of inventory once the orders are fulfilled.

The outflow has two components. The first are those products that have been delivered or are to be delivered to purchasers **18**. Again, the reason that products that have not yet been delivered but are assigned to be delivered are considered is to avoid undercounting the outflow. The second component consists of those products **12** that have been rerouted to other nodes. If the result of the calculation is a deficit or alternatively if it is below a predefined threshold then at step (**132**) it is determined that there is a shortfall. If the result is non-negative or alternatively above a threshold then at step (**132**) it is determined that there is no shortfall. Should it be determined that there is a shortfall then at step (**134**) the next batch of products issued by the seller are assigned to be sent to this node. This is accomplished by either setting the Destination Node field of the sales product table **100** to the Present Node if there is a direct link from where the products enter the circuit **25** to the present node, or by setting the Default Destination Node field as the present node if there is no direct link.

Referring now to FIGS. 6 and 7, the forecasting aspect of delivery system **10** will be further described. Specifically, FIG. 6 is a block diagram of delivery system **10** with product **12** flow quantities assigned to the various routes within delivery circuit **25** and delivery sub-circuit **30** as shown and FIG. 7 is a flowchart illustrating the process steps of the FLOW BALANCING routine conducted by the delivery system of FIG. 1.

As shown in FIG. 6, an example product flow of 100 units is shown traversing delivery circuit **25**. It is contemplated that the overall time to deliver products **12** from seller **14** to delivery circuit **25** may be a substantial period of time (e.g. 7 to 10 days). Accordingly, it is important to ensure that a sufficient supply of product **12** within delivery circuit **25** is available in order to maintain rapid delivery of product **12** to purchasers **18** within delivery system **10**. For illustrative purposes it will be assumed that product demand within delivery circuit **25** is 100 units per day (i.e. 50 units of product **12** in New York State (i.e. delivery sub-node **22b**), 25 units of product **12** in Texas (i.e. delivery node **20b**), and 25 units of product **12** in Oregon (i.e. delivery node **20e**), as shown in FIG. 6. Also for illustrative purposes it is assumed that the products 12 are shipped around the perimeter of delivery circuit 25, although it should be understood that

Referring now to FIG. 7, at step (**152**) distributor **16** obtains on a daily basis the number of products ordered and delivered over the last delivery cycle (e.g. day). At step (**154**), distributor **16** updates delivery records in distribution product database **32** and at step (**156**) provides this information to seller **14** for dissemination and storage in sales product database **30**. At step (**158**), forecasting is conducted in order to ensure that sufficient product **12** is provided to distributor **16** such that the volume of product **12** provided into delivery circuit **25** will be equal to the anticipated demand at the time that the additional product **12** is expected to enter delivery circuit **25** (e.g. within the 7 days it takes to ground ship the product **12**). Product demand is forecasted (e.g. on a daily basis) by Stock Keeping Unit (SKU) or product type for particular target regions (e.g. delivery sub-circuit **30**). While in some cases seller 14 may prefer to conduct forecasting in-house, it should be understood that either seller **14** or distributor **16** can conduct and manage the forecasting of product demand. It may be desirable to have distributor **16** provide a "turnkey" supply chain management solution to seller **14**. In such a case, it would be distributor **16** who conducts the forecasting at step (**158**) and in that case, the distribution product record would contain additional fields from the sales product table **100** for example the SKU field.

Specifically, historical data and the like will help predict the percentage increase or decrease of product demand for different times of the year (e.g. holiday season) or as the popularity of a product **12** catches on etc. (e.g. using typical product adoption curves). For example, if a company in the United States knows, from studying its history of orders and demand, that it will sell ten units in New York in the next 6 days, the company can ship them to New York (i.e. delivery node **20a**) without the associated final address destination. Shipping can be initiated knowing that it will take two days before the unit reaches the next delivery node **20b** where it would then be dispatched to purchasers **18** in Texas. The associated distribution product table **102** will be populated with addressing information that is updated or partially populated once or more than once while product **12** is in transit.

Generally, in order to provide acceptable delivery time of product **12** to purchaser **18**, it is necessary to properly estimate product demand within delivery circuit **25** and to dynamically "re-balance" the product flow of products **12** within delivery circuit **25** as products **12** are being delivered to and from delivery circuit **25**. At step (**166**), information at each node is gathered regarding the number of times a product order at that node was fulfilled from a node other than the next closest node or sub-node. Similarly, at step (**168**) for each of the products, information is obtained regarding how many nodes, and in particular, which nodes the product passed through before being sold. Then at step (**170**), it is determined whether "rebalancing" of the product flow within delivery circuit **25** is required based on the information gathered in steps (**168**) and (**170**).

For example, if, at a particular node, the number of orders fulfilled from nodes other than the next closest node or sub-node is too great then this is an indication that more products should be initially directed there. In particular, of the new products issued by the seller, a number of products corresponding to the amount observed in steps (**168**) and (**170**) should instead of being sent to the nodes from which surplus products have been redirected, should be initially directed to the nodes with shortages. In other words, at step (**172**) the par value of the nodes with shortages will be

increased while those from which surplus products are redirected will have their par values decreased.

Similarly, should there be a particular product type that consistently passes through too great a number of nodes before being sold then this is an indication that there are too many of these products in the system. To a lesser extent it could also indicate that the products are initially sent to nodes at which there is too little a demand for the products. Thus, at step (**172**) the par values for all the nodes would be lowered accordingly.

In addition, rebalancing is required where there is a large number of products **12** being transported together along delivery circuit **25** (i.e. in a "cluster") and fewer products **12** are being transported along other routes along delivery circuit **25**. In such a case, if product **12** is ordered by a purchaser **18** that is distant from the product cluster, then it can take longer to route sufficient product **12** to purchaser **18** then would be the case if there was no such cluster. If rebalancing is required, then at step (**168**), "rebalancing" is accomplished by dynamically adjusting (i.e. refining) the "destination" field of appropriate distribution product table 102 as products **12** traverses through delivery circuit **25**. For example, it is contemplated that if such a product cluster forms within delivery circuit **25**, it would be possible to re-route products **12** either to route them at a slower rate or to be routed "backwards" to reduce the volume of the product cluster. These decisions will be made by distributor **16** and carried out when product **12** reaches delivery nodes **20a** to **20e** or delivery sub-nodes **22a** to **22c** and will depend on the practical tradeoffs between storage and transportation resources.

Accordingly, delivery system **10** utilizes rebalancing to redirect or flow excess products **12** in one part of the delivery circuit **25** to areas where there are less products **12** available than anticipated sales volumes indicate. As previously discussed, it is an overriding concern to keep the flow of product **12** within delivery circuit **25** as close to the "ideal" par flow levels that are originally forecast by seller **14** (e.g. five units per day at sub-node **22a**, 10 units at sub-node **22** etc.) The goal of the rebalancing conducted within delivery system **10** is to maintain a consistent product flow through the circuit such that the majority of the products being sent to a particular delivery node

are sold while in transit but prior to arriving at that delivery node. The redirecting or flow of product around the circuit will keep unsold product moving preferably to a destination node where it has a high probability to be sold. When rebalancing is properly working within delivery system **10** there will only be a "trickle" of product traveling from one major node to another major node in order to maintain balance within the system.

Accordingly, delivery system **10** provides timely delivery of product **12** to purchaser **18** by shipping product **12** to a delivery circuit **25** for transportation within the delivery circuit **25** in advance of the purchaser's order, such that the ordered product **12** is available for delivery to purchaser **18** from a reasonably close delivery node within delivery circuit **25**. By in effect, pre-shipping product **12** for transportation within delivery circuit **25**, in advance of the customer order the delivery time to purchaser is reduced by the time it takes to initially transport product **12** from seller **14** to delivery circuit **25** (which can be a lengthy time period of 7 to 10 days). That is, major haul distances can be traversed prior to a purchase order utilizing cost effective modes of transport. From purchaser's **18** point of view, product **12** appears to have been delivered rapidly possibly using high cost transportation (e.g. air delivery). In fact, it is possible to utilize very low cost transportation for product **12** from seller to delivery circuit **25** (i.e. ocean shipping) and then within delivery circuit **25** (e.g. train). Also, by using a Unit Tracking Number (UTN) that is affixed by OEM as the key field for all related parts of the distribution chain can save costs as the package will require less handling (i.e. If a package already has a UTN number affixed by the OEM, the seller would not need to affix any additional labels to the product **12**. Finally, delivery system **10** ensures that sufficient product is provided to delivery circuit **25** based on estimated/forecasted demand. Delivery system **10** conducts periodic rebalancing of the product flow for effective delivery of product **12** to purchasers from within delivery circuit **25**.

As will be apparent to those skilled in the art, various modifications and adaptations of the structure described above are possible without departing from the present invention, the scope of which is defined in the appended claims.